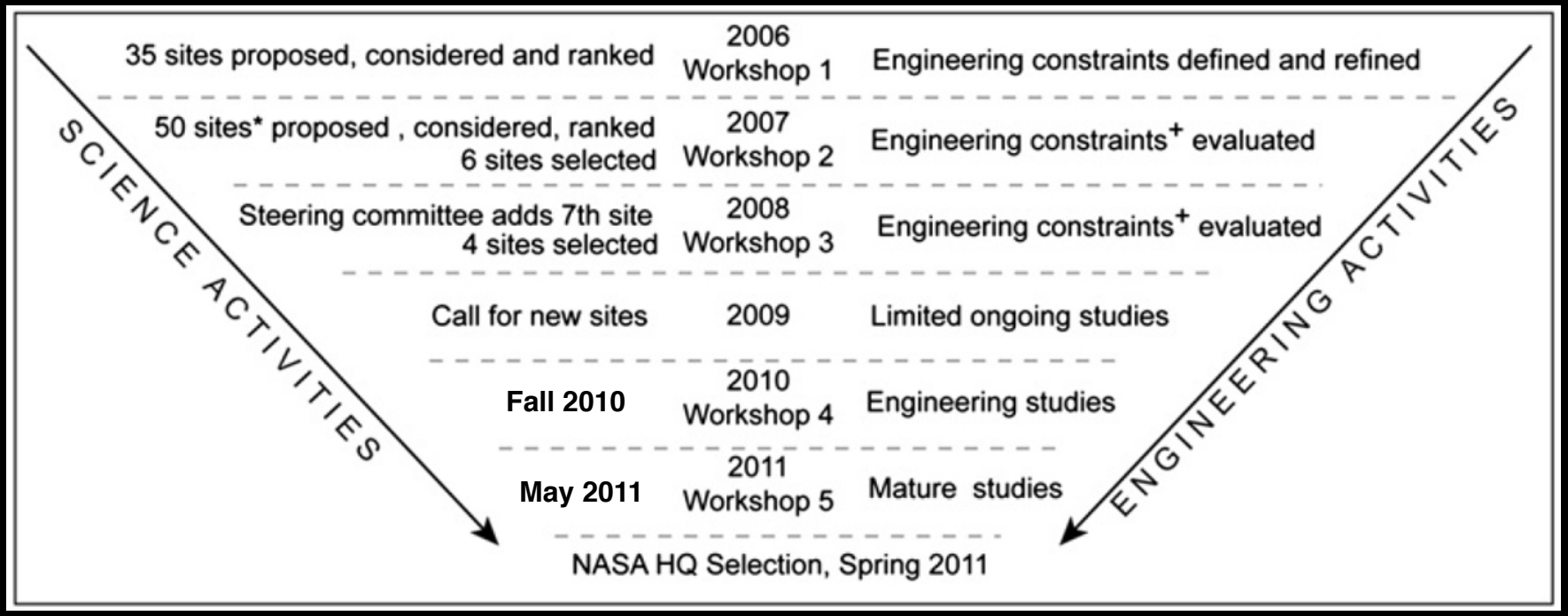
MSL Landing Site Selection Activities:

Mars Landing Site Selection Activities

A Relatively Long and Occasionally Strange Trip…

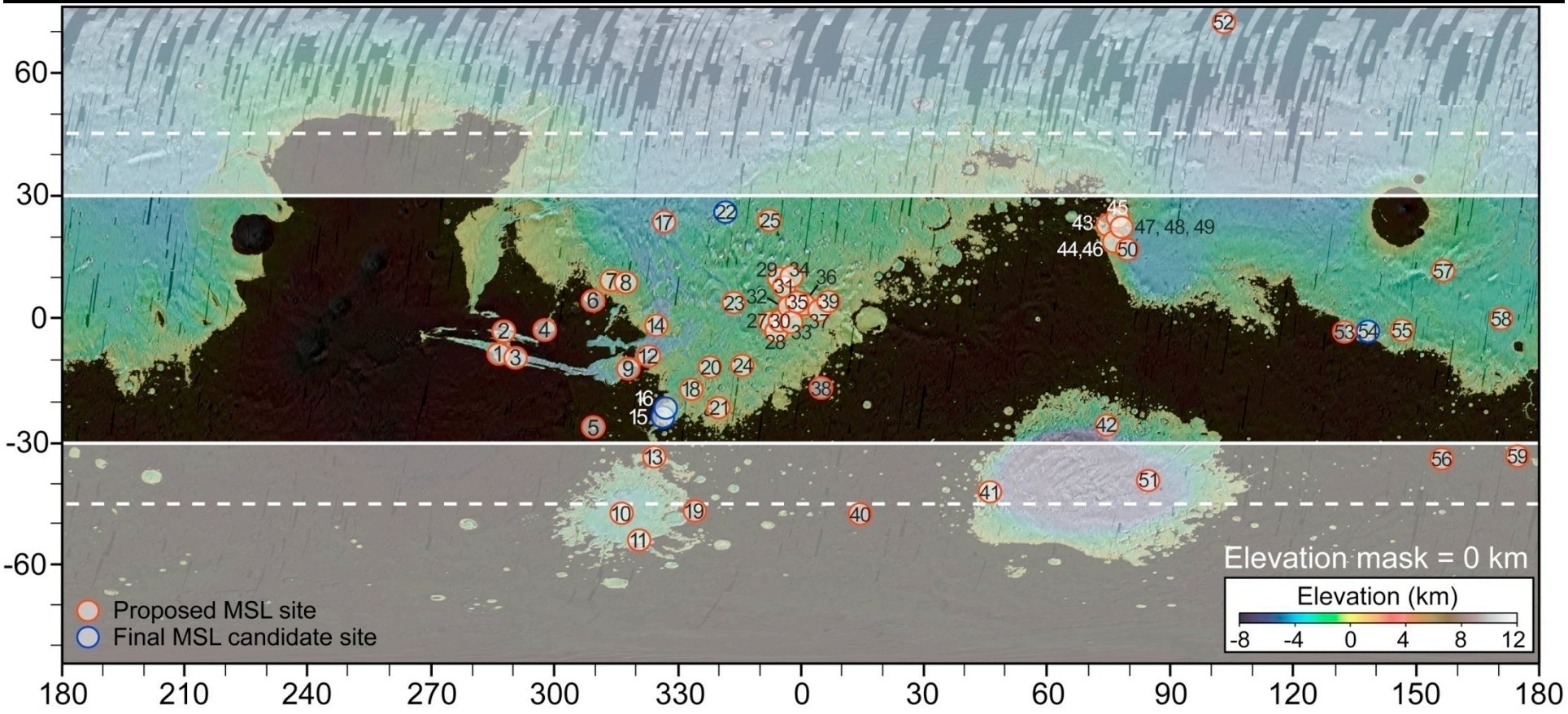


…But Remarkably Comprehensive and Scientifically Rich

John Grant, Smithsonian Institution

Proposed MSL landing sites:

Mars Landing Site Selection Activities



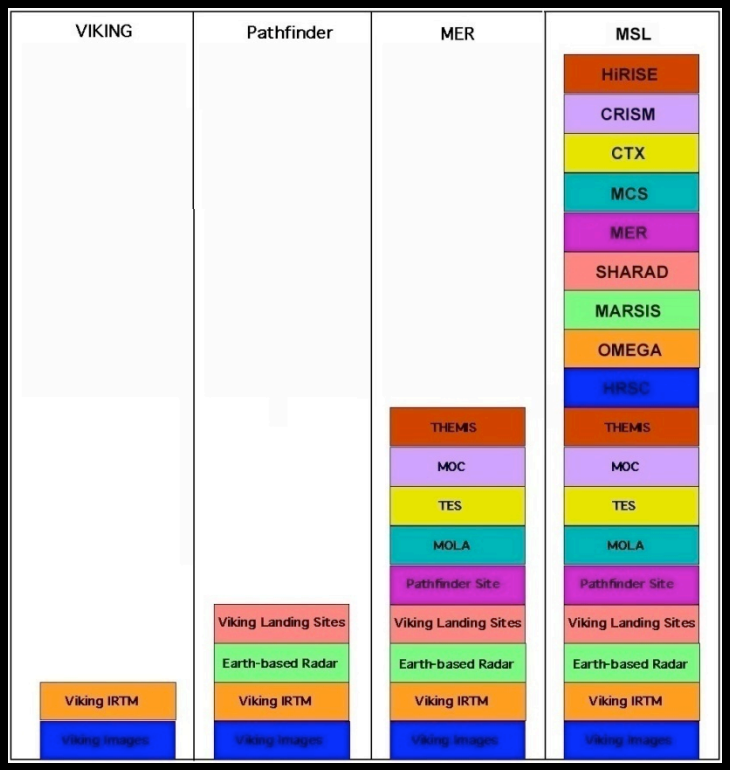
Shaded areas are above +30°N, below -30°S, and above 0 km in elevation

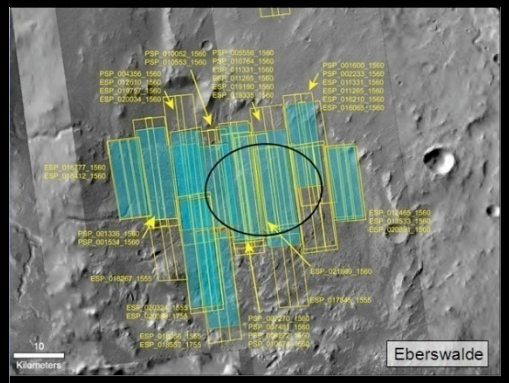
Evaluating Candidate MSL Landing Sites:

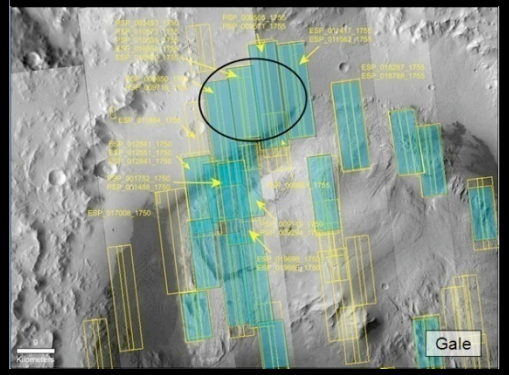
Mars Landing Site Selection Activities

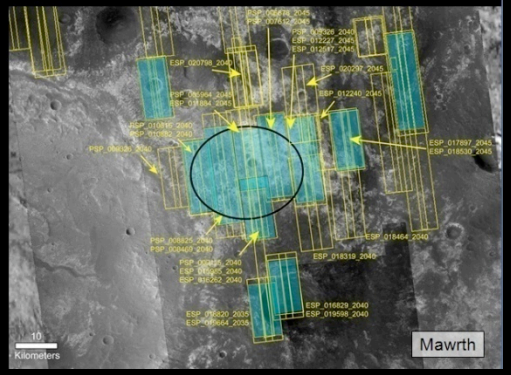
Current orbital assets have set the new standard for data required for identifying and qualifying new Mars landing sites

An incredible effort by instrument teams has gone into obtaining high quality data used to evaluate candidate sites





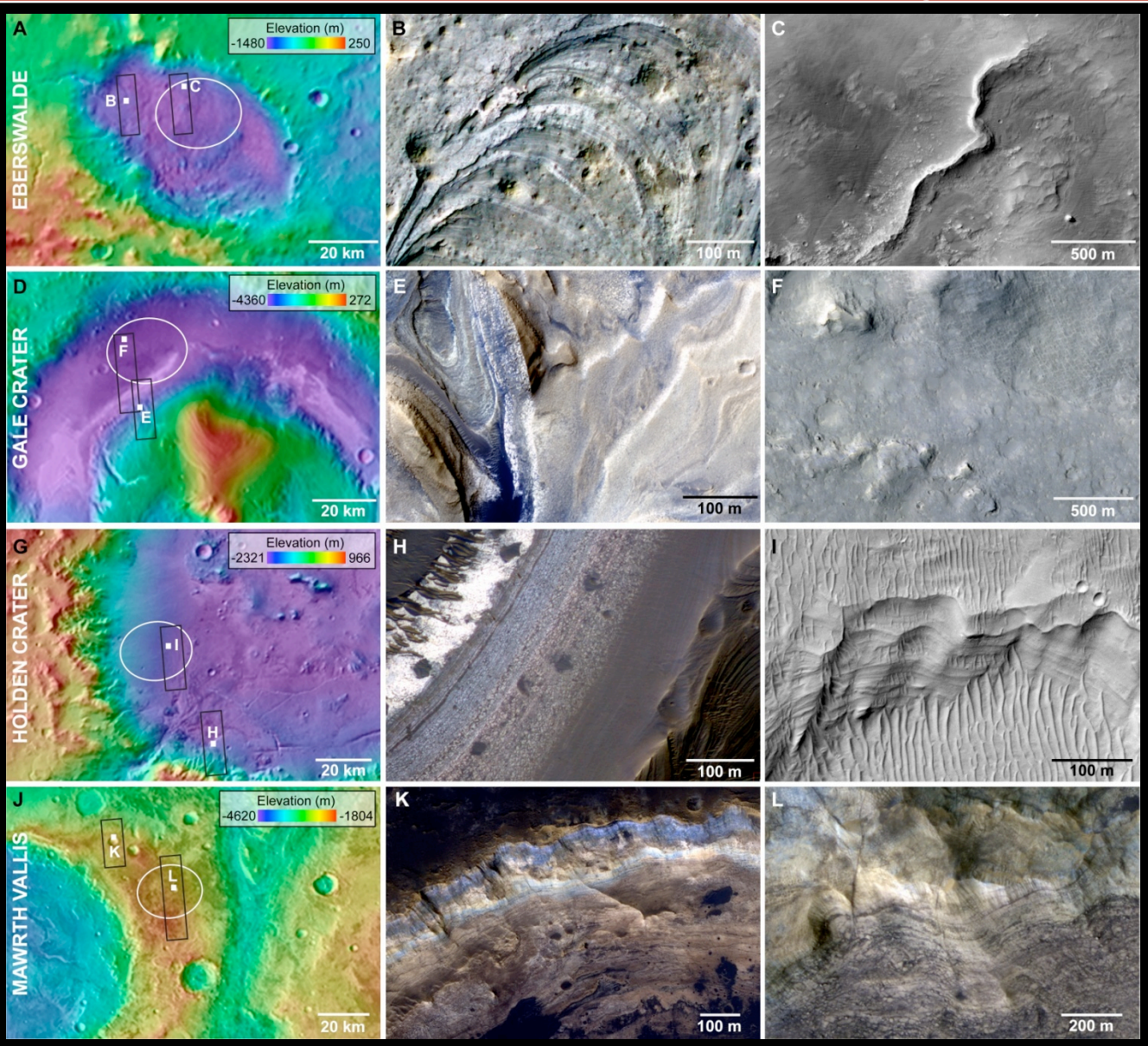




More than 200 MRO Observations of Candidate Landing Sites to Date!

Overview of the Final Four Candidate Landing Sites:

Mars Landing Site Selection Activities



Each of the final four sites represents an exciting science target

Records of the Science Process:

Mars Landing Site Selection Activities

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The science process for selecting the landing site for the 2011 Mars Science Laboratory

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ABSTRACT

The process of identifying the landing site for NASA's 2011 Mars Science Laboratory (MSL) began in 2005 by defining science objectives, related to evaluating the potential habitability of a location on Mars, and engineering parameters, such as elevation, latitude, winds, and rock abundance, to determine acceptable surface and atmospheric characteristics. Nearly 60 candidate sites were considered at a series of open workshops in the years leading up to the launch. During that period, iteration between evolving engineering constraints and the relative science potential of candidate sites led to consensus on four final sites. The final site will be selected in the Spring of 2011 by NASA's Associate Administrator for the Science Mission Directorate. This paper serves as a record of landing site selection activities related primarily to science, an inventory of the number and variety of sites proposed, and a summary of the science potential of the highest ranking sites.

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1. Introduction

The selection of the landing site for the National Aeronautics and Space Administration (NASA) 2011 Mars Science Laboratory (MSL) rover plays a crucial role in the success of the mission. Although this paper emphasizes science activities related to selection of the MSL landing site, a myriad of orbital datasets from multiple missions were utilized to characterize each potential landing site from a science and engineering standpoint. The objective of all landing site activities is to maximize the chance of landing safely with access to high-priority science targets.

Science and engineering characterization of the landing sites emphasizes data from the Mars Reconnaissance Orbiter (MRO) Compact Reconnaissance Imaging Spectrometer for Mars (CRISM, see Murchie et al., 2007), High Resolution Imaging Science Experiment (HiRISE, see McEwen et al., 2007), and Context Camera (CTX, see Malin et al., 2007) instruments, Mars Odyssey Thermal Emission Imaging System (THEMIS, see Christensen et al., 2004) instrument, Mars Global Surveyor (MGS) Mars Orbiter Camera (MOC, see Malin et al., 1992), Mars Observer Laser Altimeter (MOLA, see Zuber et al., 1992), and the Mars Express Observatoire pour la Minéralogie, l'Eau, les Glaces et l'Activité (OMEGA, Bibring et al., 2004) spectrometer and High Resolution Stereo Camera (HRSC, Jaumann et al., 2007).

The safe delivery of MSL to Mars' surface also depends upon the characterization of the atmosphere through which the spacecraft flies. The MSL spacecraft's entry, descent, and landing system involve a guided entry, parachute deployment, and a rocket-powered terminal descent to the surface. A team of atmospheric scientists has been advising the mission and providing model-based predictions of atmospheric density, winds, and the probabilities and effects of dust storms at the MSL arrival season. These atmospheric assessments will be described in a separate publication; here we focus on the terrain.

The inferred geologic setting of the site must lend confidence that the rocks and outcrops suitable for achieving core science objectives (Grotzinger, 2009; Table 1) are present and accessible. While both science and engineering aspects of landing site selection are critical to mission success, the engineering constraints trump science because there is no science return unless the mission lands safely on the surface of Mars. This paper provides a summary of the landing site selection process for the MSL rover with emphasis on the science activities related to selecting the optimal site.

Due to the diverse nature of the Martian surface and quantity of data available, the Mars science community was enlisted to assist in the site selection process via a series of workshops that were open to the science community and public. The process is modeled after the successful Mars Exploration Rover (MER) site selection process

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http://marsoweb.nas.nasa.gov/landingsites/

http://webgis.wr.usgs.gov/msl/

A link to various proposed science targets
And published papers
related to the final four candidate sites:

msl.gps.caltech.edu

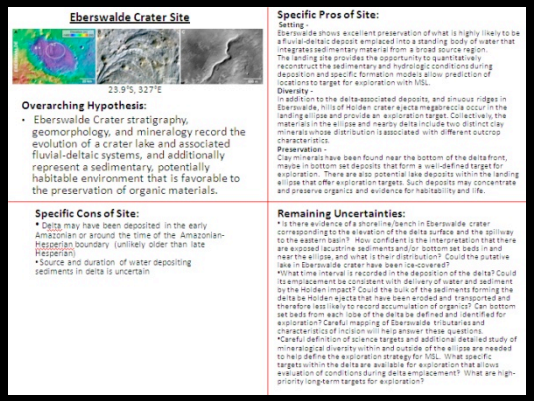
Summary Paper in
Planetary and Space Science

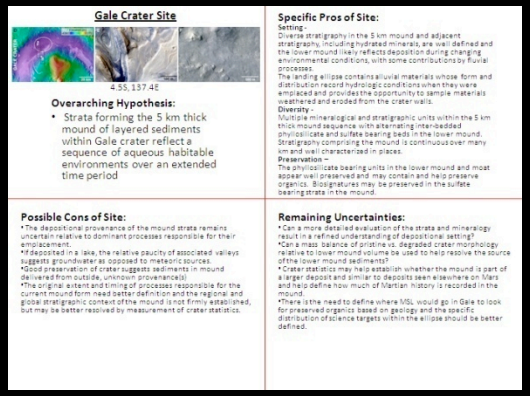
Outcome of the Fourth Workshop:

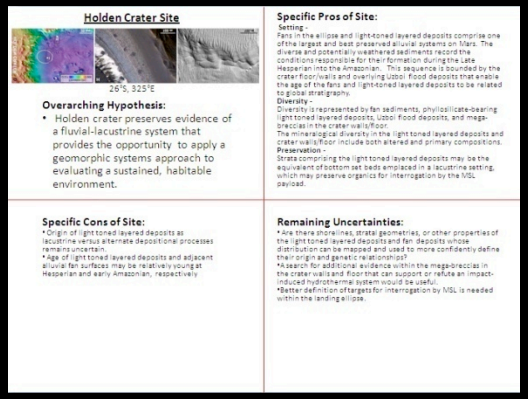
Mars Landing Site Selection Activities

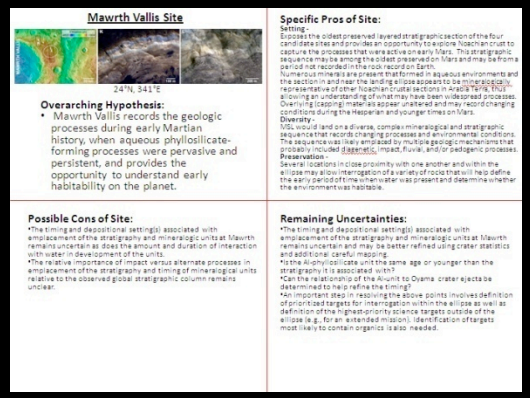
Affirmed the high science value of all four candidate sites

"We'd be happy to go to any one of them"









Emphasis is squarely on the science of the sites. So an in depth, uniform discussion of key points related to all four sites is required to establish strengths, weaknesses, and remaining uncertainties related to the science interpretation and potential of the sites.